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Notes on the Cestodes of North American Sparrows¹.

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INTRODUCTION.

Five species of cestode parasites have been recorded from the sparrow, *Passer domesticus* Linnaeus, in various localities of Europe, central Asia, and India. Two of these species have been reported from the sparrow in North America. Linton (1927) found *Paricterotaenia parina* (Duj., 1845) Fuhrmann, 1932, in sparrows collected in the vicinity of Woods Hole, Massachusetts, and Hopkins and Wheaton (1935) found *Choanotaenia passerina* (Fuhrmann, 1907) Fuhrmann, 1932, in sparrows taken at Champaign-Urbana and St. Joseph, Illinois.

During the summer of 1936, dissection of specimens of *P. domesticus*, 28 from the region of Birmingham and 26 from Huntsville, Alabama, yielded 54 cestodes. Of this number, only 23 were in condition to be mounted. All of them were found to belong to the same species. The incidence of infection of the sparrows of the Birmingham region was 28.5%, and of those from Huntsville, 15.3%. The cestodes correspond in morphology to the description given by Johnston (1909) for *Monopylidium passerinum* Fuhrmann, 1907. The following account brings together the pertinent literature concerning *P. parina* and *C. passerina* in North America, indicates that *C. passerina* is probably widely distributed among the sparrows of this continent, and provides additional evidence to support the suggestion that the specimens from *P. domesticus* in North America belong to a single species.

HISTORICAL REVIEW.

There has been much confusion in the literature concerning the genera *Choanotaenia* Railliet, 1896, *Monopylidium* Fuhrmann, 1899, and *Choanotaenia* Fuhrmann, 1908. Railliet (1896) erected the genus *Choanotaenia* and designated *C. infundibulum* Bloch, 1779 (= *T. infundibuliformis* Goeze, 1782) as type species. Fuhrmann (1899) erected *Monopylidium* to contain *Taenia crateriformis* Goeze and *Davainea musculosa* Fuhrmann, 1896. Braun (1900) designated *M. musculosum* as type of the genus. Clerc (1903) recognized *Choanotaenia* and *Monopylidium* as distinct genera. Fuhrmann (1907), in his revision of the classification of cestodes given by Braun (1894-1900), differentiated between the subfamilies Dilepininae Fuhrmann and Dipylidinae Railliet, on the basis of morphological variations of the uterus in the two groups. He referred *Choanotaenia* to the former subfamily, and *Monopylidium* to the latter one. In the same account Fuhrmann recognized the family Hymenolepinidae as distinct from Dilepinidae. Both Clerc (1903) and Fuhr-

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mann (1907) placed *C. infundibulum*, type species of *Choanotaenia*, in *Monopylidium*. To replace *C. infundibulum* as type of *Choanotaenia*, Fuhrmann (1908) designated *C. galbulae* as type species of this genus. Railliet and Henry (1909) noted that removal of the type species of *Choanotaenia* to *Monopylidium* constituted a violation of the International Code of Zoological Nomenclature. Furthermore, Ransom (1909) stated that: "*Monopylidium* must fall into synonymy if *C. infundibuliformis* (type of *Choanotaenia*) is made congeneric with *Monopylidium musculosum* (type of *Monopylidium*), *Choanotaenia* (1893) being of date prior to that of *Monopylidium* (1899). If, as Clerc and Fuhrmann believe, *C. infundibuliformis* and *M. musculosum* should go into the same genus, that genus must be known as *Choanotaenia*, not as *Monopylidium*. Such action would leave the genus *Choanotaenia* Fuhrmann, 1908 (not Railliet) without a name, and it would become necessary to rename the genus." To supplant the preoccupied name *Choanotaenia* of Fuhrmann, Railliet and Henry (1909) erected the genus *Icterotaenia*, and designated *I. galbulae* as type species.

Ransom (1909), from his observations upon *C. infundibulum*, concluded that any breaking down of the uterus as described by Clerc (1903) must be regarded as dubious. He stated further that his interpretation agreed with that of Cohn (1901), who also found the uterus persistent and possessing an "irregularly lobulated cavity incompletely subdivided by infoldings from the wall." Upon the basis of these observations, Ransom pointed out that: "If this is true, and if no further development of the egg capsules occurs, *Choanotaenia infundibuliformis* differs from *Monopylidium*, in which the uterus is said to break down into egg capsules, and it is therefore possible to recognize both *Choanotaenia* and *Monopylidium*, changing but slightly Fuhrmann's arrangement of species, namely removing *Choanotaenia infundibuliformis* from *Monopylidium* to *Choanotaenia*, where it belongs. I have not considered the differences between *Monopylidium* and such genera as *Choanotaenia*, and *Anomotaenia*, sufficiently marked to warrant placing them in different subfamilies, as Fuhrmann has done. *Monopylidium*, in spite of the breaking down of the uterus, seems to me much more closely related to the genera named than to *Dipylidium*, with which Fuhrmann has united it in a subfamily separate from the others." Ransom placed the controversial genera, and the remaining members of the subfamily Dilepininae Fuhrmann, in the subfamily Dipylidiinae Stiles, 1896, of the family Hymenolepididae Railliet and Henry, 1909, and the family "Dilepinidae" Fuhrmann, 1907, disappeared. He concluded also that *Choanotaenia* Railliet, 1896, should include certain species previously referred to *Monopylidium* Fuhrmann, 1899, and *Icterotaenia* Railliet and Henry, 1909; these genera were considered "in part" as synonyms of *Choanotaenia* Railliet, 1896.

For the invalidated *Choanotaenia* of Fuhrmann, Lühe (1910) erected the genus *Parachoanotaenia* and, among others, included in it the species *P. porosa* (Rud., 1810), but failed to designate any species as type. He recognized the genus *Choanotaenia* Railliet, Lhe. em., with species *P. Marchali* and *P. cingulifera*, and the genus *Monopylidium* Fuhrmann e.p., Lhe. em., with *M. macracanthum* Fuhrmann as sole member. These genera were placed in the family Dilepididae Fuhrmann e.p., Lhe. em. He made no mention, however, of the genus *Icterotaenia* and its type species, *I. galbulae*, or *Choanotaenia parina* Duj., which had been referred to the genus *Icterotaenia* by Railliet and Henry (1909). *Parachoanotaenia*, without a specified type, is clearly a synonym of *Icterotaenia*, and was suppressed by Fuhrmann (1932).

According to Fuhrmann (1932), the investigations of Skrjabin and Cohn on *I. galbulae*, type species of its genus, have shown that it belongs in the genus *Anomotaenia*. *Icterotaenia* thus became invalid as a generic name, and was replaced (Fuhrmann, 1932) by the genus *Paricterotaenia*, with *P. porosa* designated as type species. Furthermore, he recognized *Monopylidium* as a synonym of *Choanotaenia* Railliet, 1896. The latter, having priority, was retained as a member of the subfamily Dipylidiinae Stiles, 1896.

There is still uncertainty concerning the systematic positions of certain of the previously mentioned species. Ransom (1909) and Sprehn (1932) placed *Paricterotaenia parina* (Duj., 1845) Fuhrmann, 1932, in the genus *Choanotaenia* Railliet. Fuhrmann (1932) defined this species as a member of *Paricterotaenia* on the basis of the sacciform uterus typical of this and related species. Furthermore, the position of *C. musculosum* is dubious and information regarding this species is incomplete, as is indicated by the following statement by Fuhrmann, (1932): "nous ne savons pas si le type du genre, *Monopylidium musculosum* Fuhrmann possède une ou deux couronnes de crochets."

The taxonomic status of the species which have been reported from *P. domesticus* in North America is as follows:

Family Dilepididae Fuhrmann, 1907.

Subfamily Dilepidinae Fuhrmann, 1907.

Genus *Paricterotaenia* Fuhrmann, 1932.

Syn: *Choanotaenia* Fuhrmann, 1908 (nec Railliet, 1896).

Icterotaenia Railliet and Henry, 1909.

Parachoanotaenia Lühe, 1910.

Species *Paricterotaenia parina* (Duj., 1845) Fuhrmann, 1932.

Syn: *Taenia parina* Duj., 1845.

Taenia parina Krabbe, 1869.

Drepanidotaenia parina Stossich, 1898.

Choanotaenia parina Cohn, 1899.

Choanotaenia parina Marotel, 1899.

Choanotaenia parina Clerc, 1906.

Icterotaenia parina Railliet and Henry, 1909.

Choanotaenia parina Meggitt, 1916.

Icterotaenia parina Baer, 1925.

Subfamily Dipylidiinae Stiles, 1896.

Genus *Choanotaenia* Railliet, 1896.

Syn: *Monopylidium* Fuhrmann, 1899.

Prochoanotaenia Meggitt, 1920.

Multitesticulata Meggitt, 1929.

Viscoia Mola, 1929.

Species *Choanotaenia passerina* (Fuhrmann, 1907).

Syn: *Monopylidium passerinum* Fuhrmann, 1907.

DESCRIPTION.

The measurements of the present specimens are given in Table I. Since generic and specific distinctions are based largely on the number and arrangement of rostellar hooks and on the form of the uterus, additional data concerning these structures are presented. In sections of the scolex of Alabama specimens, the hooks have a circular arrangement on the retracted rostellum; they are uniform in length and are disposed in a single row. In whole mounts, when the rostellum is partially retracted, the hooks often manifest an irregular or alternating arrangement, probably the result of unequal muscular tension, and this condition simulates a double row. The presence, at the distal end of the rostellum, of large cells with granular cytoplasm, between which the ends of the hooks are interposed, was noted. Although there is no criterion by which the definite nature of these cells can be ascertained, it is probable that they perform some function contributory to hook formation. The neck region and scolex are covered with fine cuticular spines, those of the neck proper being somewhat longer than those of the suckers.

TABLE I.
Comparative Measurements of Cestodes from Sparrows.

Structure	<i>C. passerina</i> Johnston (1909)	<i>P. passerellae</i> Cooper (1921)	Alabama specimens	<i>P. parina</i> Linton (1927)
Scolex; breadth	0.15-0.17 mm.	0.20 (length 0.14)	0.136-0.153 mm.	0.24-0.16 mm.
Suckers; diam.	0.08 mm.	0.09 mm.	0.055-0.06 mm.	0.10 mm.
Sucker cavity; depth	0.04 mm.		0.055-0.06 mm.	
Rostellum; length	0.11 mm.		0.105 mm.	
Rostellum; diam.	0.02-0.08 mm.	0.072 mm.	0.05 mm. max.	
Number of hooks	about 20	about 20	about 20	about 20
Length hooks	row I row II 0.016mm. 0.018mm.		0.016 mm.	0.015 mm.
Neck	length breadth 0.04 mm. 0.11-0.13	length breadth 0.16 mm. 0.20 mm.	Variable	
Genital cloaca; depth	0.025 mm.		Variable	
Ventral vessel; width	0.11 mm.		0.026-0.068 mm.	
Dorsal vessel; width	0.004 mm.		0.011 mm.	
Testes; diam.	0.05 mm.	0.075 mm.	0.075 (0.065-0.089)	
Cirrus sac; length	0.17-0.20 mm.	0.25-0.27 mm.	0.195 (0.174-0.27 mm.)	
Cirrus sac; diameter	0.04 mm.	0.056 mm.	0.036 (0.03-0.045 mm.)	
Ovary; width	0.18-0.22 mm.	0.32-0.36 mm.	0.39 (0.32-0.45 mm.)	
Vitelline gland; length	0.04-0.06 mm.	0.13 mm.	0.067 (0.04-0.08 mm.)	
Vitelline gland; width	0.05-0.08 mm.	0.11 mm.	0.11 (0.08-0.14 mm.)	
Eggs; diameters	outer inner 0.05 mm. 0.04 mm.	inner? 0.025-0.03 mm.	outer inner 0.056 mm. 0.048 mm.	outer inner 0.045-0.033 mm.
Onchospheres	0.024 mm.		0.026 mm.	0.03 mm.
Onchosphere hooks	0.012 mm.		0.014 mm.	0.018 mm.
Mehlis gland		length width 0.07 mm. 0.045-5	width 0.06 (0.04-0.07 mm.)	

The uterus was noted to be initially sacciform, later anastomosing and finally divided into small chambers, corresponding rather closely to the description given for this stage and structure in *C. infundibulum* by Ransom (1909). In the anastomosing condition the uterus was observed to ramify over the segment, occupying any portion medial to the dorsal excretory vessels. At the interstices of the channels, one or a few eggs or developing embryos were observed. The uterus persists as a thin-walled structure, and, while embryos appear to be free in the parenchyma when observed under ordinary magnification, observation of frontal sections with oil immersion lenses makes apparent the folded condition of the uterine wall.

DISCUSSION.

Reference to the data presented in Table I shows that in general the material from Alabama compares favorably with that described by Johnston (1909) and with that obtained from *P. domesticus* in Illinois by Hopkins and Wheaton (1935). The latter authors gave no measurements other than length, and stated that their specimens agreed in all essential respects with the description of Johnston. This description recorded the presence of two rows of rostellar hooks, one slightly anterior to the other, the hooks in the two rows varying in length by 0.002 mm. Hopkins and Wheaton observed that most of the ripe (gravid?) proglottids were found free in the intestine. In the present specimens, a few gravid proglottids were attached to the strobilae, although most of them had become detached and were free in the intestinal contents. Investigators who fail to collect detached proglottids may not recover those segments in which the form of the uterus has reached its definitive condition.

The genera *Choanotaenia* and *Paricterotaenia* are differentiated principally on the basis of the structure of the uterus. In members of the former genus the uterus is divided into pockets; this structure in the latter remains sacciform throughout. The terms "sacciform," "lobulate" and "anastomosing" have been used to describe the uteri of the various species within the genus *Paricterotaenia*. The possibility of interpreting a transitional uterus in a posterior segment of a member of the genus *Choanotaenia* as that of a member of *Paricterotaenia* appears admissible.

Cooper (1921) considered specimens recovered from the fox sparrow, *Passerella iliaca*, sufficiently different from *P. parina* to allow the establishment of the new species *Choanotaenia passerellae* (*Paricterotaenia passerellae* according to Fuhrmann, 1932). Hopkins and Wheaton observed a close similarity between their specimens and those which Cooper described as *C. passerellae*, and, upon re-examination of the latter specimens, found that uterine pockets are present. These investigators, however, failed to record further resemblances or differences which might have been derived from the comparison. By reason of the observed deviation of *P. passerellae* from the morphology typical of the genus *Paricterotaenia*, Hopkins and Wheaton have stated that: "if the form of the uterus is a valid generic characteristic, *P. passerellae* must remain in *Choanotaenia*."

Linton (1927) recorded the characteristics and measurements of *P. parina* from the sparrows of North America (see Table I), but failed to consider the form of the uterus in his report. Meggitt (1916), in reporting this species from British birds, has also overlooked this point. Furthermore, that portion of the description of *P. parina* by Marotel (1899) used by Cooper in indicating significant differences between *P. parina* and *P. passerellae* contains no mention of the configuration of the uterus. That a close resemblance exists between *P. passerellae*, the material collected recently, and that reported by Johnston (1909) is evidenced by the Table appended. In most cases Cooper's measurements coincide, within reasonable limits, with either those of Johnston or with those taken from the Alabama material. Major discrepancies are to be observed by comparisons of the neck, vitelline gland, and cirrus. The neck and vitelline gland vary more with contraction and expansion of the segments that do the testes and the scolex with its structures. The cirrus sac, however, is moderately constant, varying but little in the sexually mature segments of the strobilae. Information as to the number of individuals measured and their condition is necessary, therefore, to elucidate the true status of *P. passerellae*. The probability of synonymy of the two species disregards the fact that *P. passerellae* has been recovered from the stomach of its host, whereas *C. passerina* is an intestinal parasite. Cestodes, however, are known to migrate from the intestine after death of the host, and have been found in the stomachs of animals dead for a long period.

Hopkins and Wheaton found that: "in the bilobed form of the ovary, and in several other features our specimens (which were identified as *Choanotaenia passerina*) and Johnston's material resemble *Paricterotaenia parina*." Upon this basis they have suggested the synonymy of the two species, although examination of the type material, which would have allowed a more definite statement regarding the true status of these species, was not possible due to its inaccessibility. It will be recalled that Fuhrmann (1932) placed the two species mentioned in different subfamilies, whereas Ransom (1909) considered them as members of the same group.

Upon the basis of these facts it seems possible that further investigation of the species of *Paricterotaenia* may necessitate the relegation of some of them to the genus *Choanotaenia*. The number of species of cestodes in the North American sparrow is at present uncertain; further investigation is necessary to negate or confirm the concept of generic or specific identity.

The specimens obtained by Hopkins and Wheaton were taken from birds which presumably had frequented the cages of infested chickens. Ackert and Reid (1937) have shown that the cysticeroid stage of *C. infundibulum* can be carried in the body of *Musca domestica*, and that flies so infected transmit the parasite to the chicken. It appears that flies may serve as intermediate hosts of *C. passerina*, and if the life history can be completed experimentally, a method for testing the host specificity of this parasite is available. Furthermore, it would be possible to determine whether or not *C. passerina* is distinct from *C. infundibulum*. Such a test, using infected flies in an attempt to parasitize young chicks with *C. passerina*, is contemplated.

SUMMARY.

54 specimens of *P. domesticus*, taken in Alabama, provided 23 cestodes which have been tentatively identified as *Choanotaenia passerina*.

In sections of the retracted rostellum the hooks of these specimens appear to be arranged in a single row. In whole mounts with partially retracted rostellum the hooks exhibit an alternating or irregular arrangement which may simulate a double row.

The uterus is sacciform, anastomosing, and divided into uterine pockets in successive stages of its development. The above conditions suggest the possibility of diverse interpretations of material taken at different levels from identical specimens.

A method for testing the host specificity of *C. passerina* is suggested, depending upon the infection of *M. domestica* with the cysticeroids of *C. passerina*.

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